United States Environmental Protection Agency **Office of Research and Development**

National Exposure Research Laboratory
Research Abstract

Government Performance Results Act (GPRA) Goal 5
Annual Performance Measure 73

Significant Research Findings:

Prototype Soil Sampler for Sampling Volatile Organic Compounds from Contaminated Soils

Scientific Problem and Policy Issues

Nearly all environmental research programs require the collection of samples in the field. However, the overwhelming majority of efforts (in terms of time and cost) to control and quantify error components in the data are concentrated on laboratory analyses. It has been repeatedly stated that field error accounts for 80% of the total error for the more stable contaminants (e.g., metals, PCBs, and pesticides) and up to 99.99% of the total error for non-stable contaminants (e.g., volatile organic compounds; (VOCs)). This research effort was designed to help reduce or eliminate the loss of VOCs that typically occurs during sampling. These unknown and unquantified losses may result in data that underrepresents actual site contamination, potentially biasing decisions to remediate sites and leaving significant concentrations of VOCs in the soils. As a result of these research efforts, the data collected will better represent and define the extent and degree of contamination at any VOC-contaminated site. With the more accurate and precise data, the need for remedial actions can be better determined and the health of the public can be better protected.

Research Approach

The focus of this research was to examine currently used soil sampling tools to identify areas where VOCs are lost during sample collection and handling. Once the VOC loss points were identified, a new sampling tool that reduces or eliminates the VOC losses was designed and manufactured. Typically, a VOC-contaminated soil is collected at some depth below the soil surface and brought to the surface, where the core collection tube is opened, exposing the sample to the atmosphere. A subsample is collected and then transferred to a glass vial that is ultimately attached to the analytical instrument. The new prototype sampler allows for the direct collection of the soil sample into the glass vial (at depth in the soil) which, in turn, is placed directly onto the analytical instrument. The prototype sampler markedly reduces one of the main sources of VOC loss, namely, sample exposure to the atmosphere leading to contaminant volatilization.

Results and Impact

Initial physical integrity testing to ensure that the glass vials did not break during sampling were moderately successful, but a new cutting tip design, with a slotted head to allow for the easy removal of the tip (which contains the glass vial), eliminated all vial breakage that occurred in the original design. The new cutting

	tip design also restricted the collected sample size, with typical sample weights ranging from approximately 5 to 9 grams which is consistent with recommendations of SW-846 method 5035 to collect and analyze samples of approximately 5 grams. The chemical integrity of the method was tested by comparing VOC concentrations in samples collected using the prototype sampler and those collected using the commonly employed sampling technique of collecting a sample from a core with a cut-off syringe and transferring the sample to the glass vial. Samples have been collected at two Superfund sites, and analyses of these samples are currently underway. This research project helps satisfy the FY02 Annual Performance Goal (APG) 9 entitled, "Provide at least 2 new soil sampling and on-site screening methods." This APG is part of the larger Government Performance and Results Act (GPRA) subobjective that is aimed at improving site characterization, site monitoring, and modeling of contaminant fate and transport in the environment. In brief, the new prototype soil sample tool described here will, by reducing the sampling losses of volatile contaminants, increase the accuracy and precision associated with site characterization. By knowing what contaminants are present, where they are located, and what will happen to them if they remain untreated at a site, regulators and the general public can more accurately prescribe actions necessary to clean-up a site and return it to its natural uncontaminated state.
Research Collaboration and Research Products	The conceptual design of the prototype sampler was that of Dr. Brian Schumacher, U.S. Environmental Protection Agency (EPA), and Mr. Steven Ward, employed at the Harry Reid Center of the University of Nevada - Las Vegas at the time of initial design preparation. The conceptual design for the prototype sampler was taken (after open bidding on a contract to produce the sampler) to Associated Design and Manufacturing of Alexandria, Virginia, where a final design was developed and the prototype samplers made. Physical and chemical integrity of the prototype sampler were tested in conjunction with a contract to Lockheed-Martin Environmental Services of Las Vegas, Nevada. There have been no publications to date due to ongoing chemical integrity testing.
Future Research	The chemical integrity testing will continue at several more Superfund or other contaminated sites that have different soil types and will test the robustness of the prototype sampler.

Contacts for Additional Information

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